

Patent Claims

1. A "frigate" vessel-type equipment system having
standard equipment segments, such as a power
5 generator segment, a power distribution segment, a
propulsion segment and an automation segment, and
having a vessel hull (1) which is matched to the
"frigate" vessel-type equipment system on a size
and requirement-specific basis,
10 characterized in that at least one standard
equipment segment, such as the power generator
segment and/or the power distribution segment
and/or the propulsion segment and/or the
automation segment, is formed from standard units
15 or components which are arranged in accordance
with the requirements in the vessel hull (1) of
the "frigate" vessel-type equipment system, and
which can be installed in vessel hulls of
different vessel-type equipment systems.
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2. The "frigate" vessel-type equipment system as
claimed in claim 1, in which the propulsion
segment comprises a combination of two POD
propulsion segments (2, 3), which are preferably
25 in the form of completely electrical lightweight
POD propulsion systems and preferably have a power
of 6 to 8, and in particular 7 MW, and have two
waterjet propulsion segments (4, 5), which are
preferably in the form of twin waterjet propulsion
30 systems and preferably have a power of 12 to 16,
in particular 14 (2x7), MW.
3. The "frigate" vessel-type equipment system as
claimed in claim 1 or 2, whose propulsion segment
35 includes a thruster segment (6), preferably a
0.5 MW bow jet thruster.

4. The "frigate" vessel-type equipment system as
claimed in claim 2 or 3, in which electric motors in
the POD propulsion segments (2, 3) and/or in the
waterjet propulsion segments (4, 5) and/or in the
5 thruster segment (6) are designed with windings
composed of high-temperature superconductors.

5. The "frigate" vessel-type equipment system as claimed in claims 2 to 4, in which the electric motors in the POD propulsion segments (2, 3) and/or in the waterjet propulsion segments (4, 5) and/or in the thruster segment (6) are in the form of synchronous machines with a field winding composed of high-temperature superconductors, and with the stator windings being in the form of air-gap windings.
6. The "frigate" vessel-type equipment system as claimed in claims 2 to 5, whose waterjet propulsion segments (4, 5) are equipped with a coaxial exhaust-gas nozzle segment.
7. The "frigate" vessel-type equipment system as claimed in claims 2 to 6, in which - in the longitudinal direction - the distance between the center of the POD propulsion segments (2, 3) and the nose of the traction propeller (17) of the POD propulsion segment (2, 3) on the one hand, and the water outlet opening of the pods of the waterjet propulsion segments (4, 5) on the other hand is approximately 25 to 35 m, approximately 22 to 32 m.
8. The "frigate" vessel-type equipment system as claimed in one of claims 2 to 7, whose vessel hull (1) is structurally designed in the aft area such that it has the strength to hold the weight of the two POD propulsion segments (2, 3) which each, for example, weigh approximately 65 tonnes, as well as the associated units, such as converters, controllers etc. whose weight is, for example, approximately 20 to 30 tonnes, and to absorb the axial forces which occur as a result of the

operation of the two POD propulsion segments (2, 3).

- 5 9. The "frigate" vessel-type equipment system as
claimed in one of claims 1 to 8, in which the
power generator segment is formed from a
combination of preferably four fuel cell segments
(7, 8, 11, 12), which are preferably in the form
of air-breathing PEM fuel cells each having a
10 power of approximately 4.5 MW (net) or 6 MW
(gross), and/or preferably two generator segments
(9, 10), preferably gas-

turbine-powered generators, each having a power of approximately 16 MW.

- 5 10. The "frigate" vessel-type equipment system as claimed in claim 9, whose power generator segment also has high-power batteries by means of which the fuel-cell segments (7, 8, 11, 12) can be started up.
- 10 11. The "frigate" vessel-type equipment system as claimed in claim 9 or 10, whose generators (9, 10) have windings composed of a high-temperature superconductor.
- 15 12. The "frigate" vessel-type equipment system as claimed in claim 9 or 10, whose generators (9, 10) are in the form of synchronous machines with a field winding composed of high-temperature superconductors, with the stator windings being in
20 the form of air-gap windings.
- 25 13. The "frigate" vessel-type equipment system as claimed in one of claims 9 to 12, whose four air-breathing PEM fuel cells (7, 8, 11, 12) are associated, in order to supply them with hydrogen, with two diesel reformers (13, 14) each having a power of approximately 9 MW.
- 30 14. The "frigate" vessel-type equipment system as claimed in one of claims 1 to 13, whose power generator segment is distributed over a number of ship protection areas SSB-1, SSB-2 and SSB-3 in the "frigate" vessel type equipment system.
- 35 15. The "frigate" vessel-type equipment system as claimed in claims 10 to 14, in which a first electrical system with two air-breathing PEM fuel

cells (7, 8) is arranged in a stern-end, first ship protection area SSB-1, preferably close to the transition to a midships, second vessel protection area SSB-2.

16. The "frigate" vessel-type equipment system as claimed in one of claims 9 to 15, in which a second electrical system, which is subdivided into a stern-end electrical system section with two gas turbines (15, 16) and a bow-end electrical system section with generators (9, 10), is arranged in a midships, second vessel protection area SSB-2.
17. The "frigate" vessel-type equipment system as claimed in claim 16, in which the stern-end (15, 16) electrical system section (9) and the bow-end electrical system section (10) of the second electrical system are arranged in adjacent compartments VIII, IX in the midships, second vessel protection area SSB-2.
18. The "frigate" vessel-type equipment system as claimed in one of claims 9 to 17, in which a third electrical system having two air-breathing PEM fuel cells (11, 12) is arranged in a third vessel protection area SSB-3, which is arranged between the second, midships vessel protection area SSB-2 and a bow-end vessel protection area SSB-4, preferably close to the transition to the midships, second vessel protection area SSB-2.
19. The "frigate" vessel-type equipment system as claimed in one of claims 9 to 18, in which a first diesel reformer center with a diesel reformer (13) is arranged in the midships, second vessel protection area SSB-2, preferably in its compartment IX which accommodates the bow-end electrical system section (9, 10) of the second electrical system.
20. The "frigate" vessel-type equipment system as claimed in one of claims 9 to 19, in which a

second diesel reformer center with a diesel reformer (14) is arranged in the third vessel protection area SSB-3, which is arranged between the midships, second vessel protection area SSB-2 and the bow-end vessel protection area SSB-4, preferably close to the transition to the bow-end vessel protection area SSB-4.

21. The "frigate" vessel-type equipment system as claimed in one of claims 2 to 20, whose POD propulsion segments (2, 3) are designed for the "frigate" vessel-type equipment system to travel at a cruise speed of, for example, approximately 22 knots, and can be supplied with electrical power in this operating state by means of the fuel cell segments (7, 8, 11, 12).
22. The "frigate" vessel-type equipment system as claimed in one of claims 2 to 21, whose waterjet propulsion segments (4, 5) are designed for the "frigate" vessel-type equipment system to travel at a top speed of, for example, approximately 26 knots, and can be supplied with electrical power in this operating state by means of the two generators (9, 10).
23. The "frigate" vessel-type equipment system as claimed in one of claims 2 to 22, whose waterjet propulsion segments (4, 5) can be supplied with electrical power from at least one fuel cell segment (7, 8, 11, 12) until the power limit of the fuel cell segment or segments (7, 8, 11, 12) is reached in order to start up these waterjet propulsion segments (3, 4) with low emissions.
24. The "frigate" vessel-type equipment system as claimed in one of claims 2 to 23, which achieves speeds of more than 30 knots by operating its POD propulsion segments (2, 3) and its waterjet propulsion segments (4, 5) simultaneously, in which case the distribution of the electrical power which is produced by means of the power generator segment can be achieved with optimized efficiency by means of the power distribution

segment and energy management for an automation carrier system vessel (33).

25. The "frigate" vessel-type equipment system as
5 claimed in one of claims 2 to 24, whose power
distribution segment has a propulsion network (18,
19) which is fed from fuel cells and by means of
which the POD propulsion segments (2, 3) can be
supplied with electrical power, and has a
10 generator-fed propulsion network (21), by means of
which the waterjet propulsion segments (4, 5) can
be supplied with electrical power.

26. The "frigate" vessel-type equipment system as claimed in claim 25, in which the propulsion network (18, 19) which is fed from fuel cells has a stern-end network section (18) which is essentially associated with the stern-end, first vessel protection area SSB-1, and has a bow-end network section (19) which is essentially associated with the third vessel protection area SSB-3 and can be connected to the stern-end network section (18) via suitable coupling elements (20).
27. The "frigate" vessel-type equipment system as claimed in claim 25 or 26, in which the generator-fed propulsion network (21) is essentially associated with the midships, second vessel protection area SSB-2 and can be connected to the propulsion network (18, 19), which is fed by means of fuel cells, by means of suitable coupling elements (22, 23).
28. The "frigate" vessel-type equipment system as claimed in claim 26 or 27, in which an auxiliary propulsion system (24), which is arranged in the bow-end vessel protection area SSB-4, can be supplied with electrical power by means of the bow-end network section (19) of the propulsion network (18, 19) which is fed by means of fuel cells.
29. The "frigate" vessel-type equipment system as claimed in one of claims 25 to 28, in which on-board network loads, for example weapon system units (25, 26), can be supplied with electrical power from the entire power generation segment, advantageously by means of the propulsion network (18, 19) which is fed by means of fuel cells.

30. The "frigate" vessel-type equipment system as claimed in one of claims 25 to 29, having low-voltage electrical systems (27, 28, 29), which are arranged in various vessel protection areas SSB-1, SSB-2, SSB-3 can be connected to the respectively associated propulsion network (18, 21, 19) and can be connected to one another by means of suitable coupling elements (30, 31, 32).
31. The "frigate" vessel-type equipment system as claimed in one of claims 1 to 30, whose automation segment (33)

includes an automation center (34) which has a large number of terminals (36) and a terminal bus (35), and has two or more servers which are connected to the terminal bus (35) and to a system bus (38), and to which control networks (39, 40, 41) which are associated with different vessel protection areas SSB-1, SSB-2, SSB-3 and SSB-4 are connected.

32. The "frigate" vessel-type equipment system as claimed in claim 31, having a first control network (39) which is essentially associated with the stern-end, first vessel protection area SSB-1 and with which the two POD propulsion segments (2, 3), the two fuel-cell segments (7, 8) which are arranged astern, the diesel reformer (13) which is arranged astern, and the vessel protection engineering (42) which is provided in the stern-end, first vessel protection area SSB-1 are associated.

33. The "frigate" vessel-type equipment system as claimed in claim 31 or 32, having a second control network (40), which is essentially associated with the midships, second vessel protection area SSB-2 and with which the two generators (9, 10), the two waterjet propulsion segments (4, 5) and the vessel operating engineering (43), which is provided in the midships, second vessel protection area SSB-2, are associated.

34. The "frigate" vessel-type equipment system as claimed in claims 31 to 33, having a third control network (41), which is essentially associated with the third vessel protection area SSB-3 and the bow-end vessel protection area SSB-4 and with which the two fuel cell segments (11, 12) which is arranged in the bow, the diesel reformer (14),

which are arranged in the bow, the thruster

segment (6) and the vessel operating engineering (44) which is provided in the third vessel protection area SSB-3 and in the bow-end vessel protection area SSB-4 are associated.